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First records of *Clathrus* (*Phallaceae, Agaricomycetes*) from the Northeast Region of Brazil

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Abstract — Two *Clathrus* specimens were collected in Northeastern Brazil during the rainy season in 2008. One specimen was identified as *C. chrysomycelinus* and the other is described as a new species, *C. cristatus,* which is distinguished by its pale red to pink receptacle and crests along the edge. Full descriptions with illustrations of the collected specimens and a key to species of *Clathrus* from Brazil are provided.

Key words — *Clathraceae*, gasteromycetes, Neotropical mycodiversity

Introduction

Clathrus P. Micheli ex L. was validated in 1753; the type species is *C. ruber* P. Micheli ex Pers. According to the most recent edition of the Dictionary of Fungi, this genus embraces 16 species, which are widespread in tropical and subtropical areas (Kirk et al. 2008).

In his treatment of the *Clathraceae,* Dring (1980) recognized 15 species and a specimen that he labelled "*Clathrus* species 1" due to the fact of having studied only a single basidioma preserved in spirit on which to base his formal diagnosis. García & López (1995) later proposed *C. mexicanus* as a new species; examination of the type material by one of us (Dr. Calonge), however, led to the conclusion that its taxonomic status is doubtful, because the basidioma

is abnormal and does not give enough information to clarify its real identity (Calonge et al. 2004). Other recent additions to the genus are *C. xiningensis* (H.A. Wen) B. Liu. (Fan et al. 1994) and *C. hainanensis* X.L. Wu (Wu 1998).

The genus is characterized by a latticed, clathrate receptacle composed of hollow, tubular arms that arise from the basal tissue within the volva (Miller & Miller 1988). The deliquescent gleba usually develops on the inner side of the receptacle and the basidiospores are elliptical and smooth (Dring 1980). The unpleasant odor produced by the gleba attracts flies and other insects, contributing to basidiospore dissemination (Maldonado-Ramírez & Torres-Pratts 2005).

The existence of the genus in Brazil has been known since the 19th century. Fidalgo (1974) reported that a *Clathrus* specimen gathered in 1826 by William John Burchell comprised the first collection of a gasteroid fungus in the country. To date, five *Clathrus* species have been recorded from Brazil (see key below) and their range is so far restricted to the Southern regions (Trierveiler-Pereira & Baseia 2009). *Clathrus chrysomycelinus,* which is the species with the widest distribution in the country, has been recorded from four states: Rio Grande do Sul (Rick 1961), Santa Catarina (Möller 1895), Paraná (de Meijer 2006), and São Paulo (Bononi et al. 1984). Two other species recorded from Brazil, *C. americanus* Lloyd and *C. pseudocrispus* Lloyd, are considered synonyms of *C. crispus* Turpin (Dring 1980).

During recent field expeditions in preserved areas of Northeastern Brazil, two distinct species of *Clathrus* were collected, one of them new to science. The purpose of this study is to present full descriptions and photos of these species and an identification key to species of *Clathrus* recorded from Brazil.

Materials and methods

Gasteromycete collection was carried out during the rainy season of 2008 (March-August) in preserved forests areas of Northeastern Brazil. RPPN Fazenda Tamanduá (7º00'35"S, 37º23'50"W) is a 325 ha remnant of 'caatinga' (xeric shrubland and thorn forest), located in the city of Santa Terezinha, state of Paraíba. Parque Ecológico João de Vasconcelos Sobrinho (8º17'00"S, 35º58'3"W), also known as 'Brejo dos Cavalos', is a 359 ha remnant of the Atlantic rain forest located in the city of Caruaru, state of Pernambuco.

Basidiomata were examined and photographed in the field. A taxonomic study was performed by observing macro and microscopic features according to Miller & Miller (1988) and Dring (1980). For scanning electron microscopy (SEM), a few drops of isopropyl alcohol were added to gleba samples, coated with gold-palladium on an Ion Sputter Coater, and observed under a Shimadzu SSX-550 scanning electron microscope. Colours were coded according to Kornerup & Wanscher (1978), with the indication "KW" bracketed in the text, and simultaneously described. Vouchers were dried slowly and are kept in the herbaria UFRN-fungi and URM (Holmgren & Holmgren 1998).

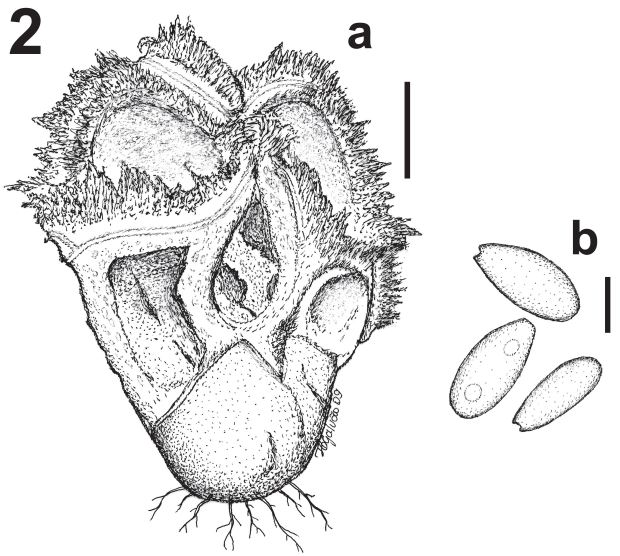
Figure 1. *Clathrus cristatus*. Basidiome in situ (scale bar = 2 cm).

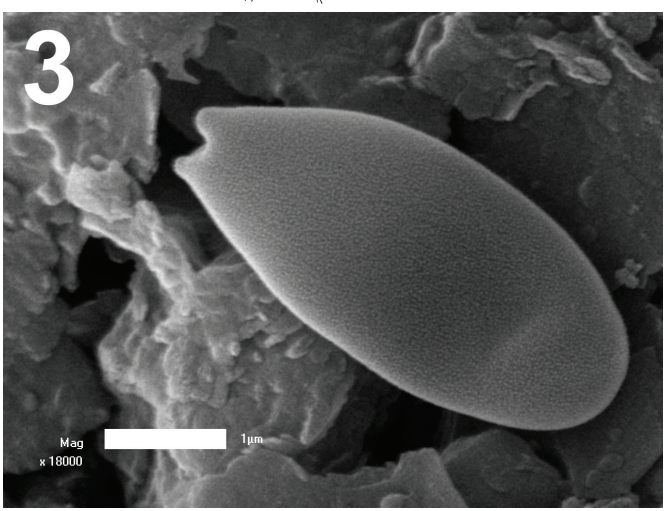
Taxonomy

Clathrus cristatus Fazolino, Calonge & Baseia, **sp. nov.** Figs 1–3

MycoBank MB 515357

Volva 1.5–2 cm diam., subglobosa, brunnea-pallida, reticulata, irregulariter dehiscenten, rhizomorphis basalis albis. Receptaculo 5 cm alto, 3 cm lato; obovoideo, clathrato cum rami in dispositio symmetricus, roseus in parte externa et scarlatinus ad facies interna, margine cristata. Gleba in facies interna ad rami, olivaceus, odore grato; basidiosporis 3.5–5 × 1.5–2 micra, cylindrico-ellipsoideis, chlorohyalinis, laevis.





Figures 2–3. *Clathrus cristatus*.
2a. Basidiome (scale bar = 1 cm), 2b. Basidiospores (scale bar = 2 µm).
3. SEM of basidiospore (scale bar = 1 µm).

Type — BRAZIL. Paraíba: Santa Terezinha. RPPN Fazenda do Tamanduá. col. E.P. Fazolino 068. 23.III.2008 (*UFRN-fungi 0492*, **holotype**).

Etymology — *cristatus* refers to the presence of crests on the edge of the top network.

Volva 1.5–2 cm diam., subglobose, light brown (KW 5D7), with a network of grooves, rooting at the base by several whitish hyphal strands (rhizomorphs); dehiscence by irregular splitting of the apex. Receptacle 5 cm high × 3 cm diam, obovoid, clathrate with a more or less symmetrical arrangement of the arms to give an irregular network of about eight meshes, with longitudinal grooves at the top ones (Fig. 1, 2), arms 4–6 mm in length, fused at the base, pastel red (KW 10A4) on the outside, shading to red (KW 10A7) within, transverse section of an arm shows two flattened tubes; upper meshes are surrounded by a fringe of crests, crests 1–5 mm long. Gleba borne on the inner face of the arms, distributed all along the arms, olivaceous (KW 3F7), odour of cheese; basidiospores 3.5–5 × 1.5–2 μm, cylindric-ellipsoid, faintly greenish tinted (chlorohyaline), smooth (Fig. 1, 3), at high magnification the surface may appear rugulose, but this is an artifact.

Habitat — growing solitary on sandy soil.

Taxonomic remarks — *Clathrus cristatus* is distinguished by its pale red to pink receptacle and crests along the arms edges. *Clathrus preussii* Henn. also shows a fringe of teeth along the edge but these are fewer, smaller and shorter and the receptacle is dirty white. *Clathrus cristatus* arms may also resemble *Laternea pusilla* Berk. & M.A. Curtis, but a careful analysis will show that the receptacle morphology is quite different between the two species.

Clathrus chrysomycelinus Möller, Bot. Mitt. Trop. 7: 22 (1895). Fig 4

Material examined — **BRAZIL. Pernambuco: Caruaru**. Parque Ecológico João de Vasconcelos Sobrinho, col. L. Trierveiler-Pereira & al., 105. 17.VI.2008 (*URM 80094*).

Volva 1.9 cm high × 2.9 cm diam, ellipsoid, external layer dark brown (KW 6F4), internal layer yellowish grey (KW 3B2), content gelatinous, rotting at the base by a central rhizomorph, up to 9 cm long, dull yellow (KW 3B4). Receptacle 5.4 cm high × 4 cm diam, subglobose to obovate, meshes more or less hexagonal, isodiametric in the upper part and elongates below, where the arms are fused and form a short stipe, arms very fragile, slender and flattened (Fig. 4), white (KW 3A1) to pale yellow (KW 4A3), stipe 1.5 cm high × 1 cm diam. Gleba restrict to glebifers that are situated at the arms junctions, olive (KW 2F6), foetid; basidiospores 3.5–4.5 × 1.5–2 μm, ellipsoid, chlorohyaline, smooth.

Habitat — growing solitary on soil among litter.

Taxonomic remarks — Due to its white color, *C. chrysomycelinus* resembles *C. preussii* but lacks the fringe of teeth along the edge. The species may also be confused with the two *Ileodictyon* species: *I. cibarium* Tul. & C. Tul. and *I. gracile* Berk., since the receptacle color and the arm morphology are somewhat

Figure 4. *Clathrus chrysomycelinus*. Basidiome in situ (scale bar = 2 cm).

similar. However, in *Ileodictyon* the receptacle arms are not fused to form a short stipe and the whole receptacle occasionally becomes detached from the volva. Moreover, *Ileodictyon* species have a gelatinous receptacle and simple tubular (circular in trans-section) arms without dorsiventral differentiation (Dring 1980, Miller & Miller 1988).

Key to *Clathrus* species recorded from Brazil

1a. Receptacle white, yellowish white to pale yellow 2
1b. Receptacle bright red, reddish orange to very pale red 3
2a. Arms with a fringe of small membranous teeth along the edge ..... *C. preussii*
2b. Arms without a fringe of membranous teeth ..... *C. chrysomycelinus*

3a. Receptacle pale red to pink, dense membranous teeth along the edge . . *C. cristatus*
3b. Receptacle bright red to reddish orange, arms without membranous teeth 4
4a. Receptacle formed by 2-5 thick, columnar arms, not forming meshes *C. columnatus*
4b. Receptacle arms forming meshes 5
5a. Arms massive, up to 1 cm wide, triangular in transaction, meshes surrounded by gleba, gleba forming a crown . . . . . *C. crispus*
5b. Arms slender, more or less circular in transaction, meshes without gleba forming a crown . . . . . *C. pusillus*

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